



Sea Level Rise Study Summary

Town of South Bethany



May 26, 2016

This presentation was prepared by Anchor QEA for the Town of South Bethany using Federal Funds under award NA14 NOS 419 0123 from the Delaware Coastal Programs and the Office for Coastal Management (OCM), National Oceanic and Atmospheric Administration (NOAA), U.S. Department of Commerce. The statements, findings, conclusions, and recommendations are those of the authors and do not necessarily reflect the views of the OCM, NOAA or the U.S. Department of Commerce.

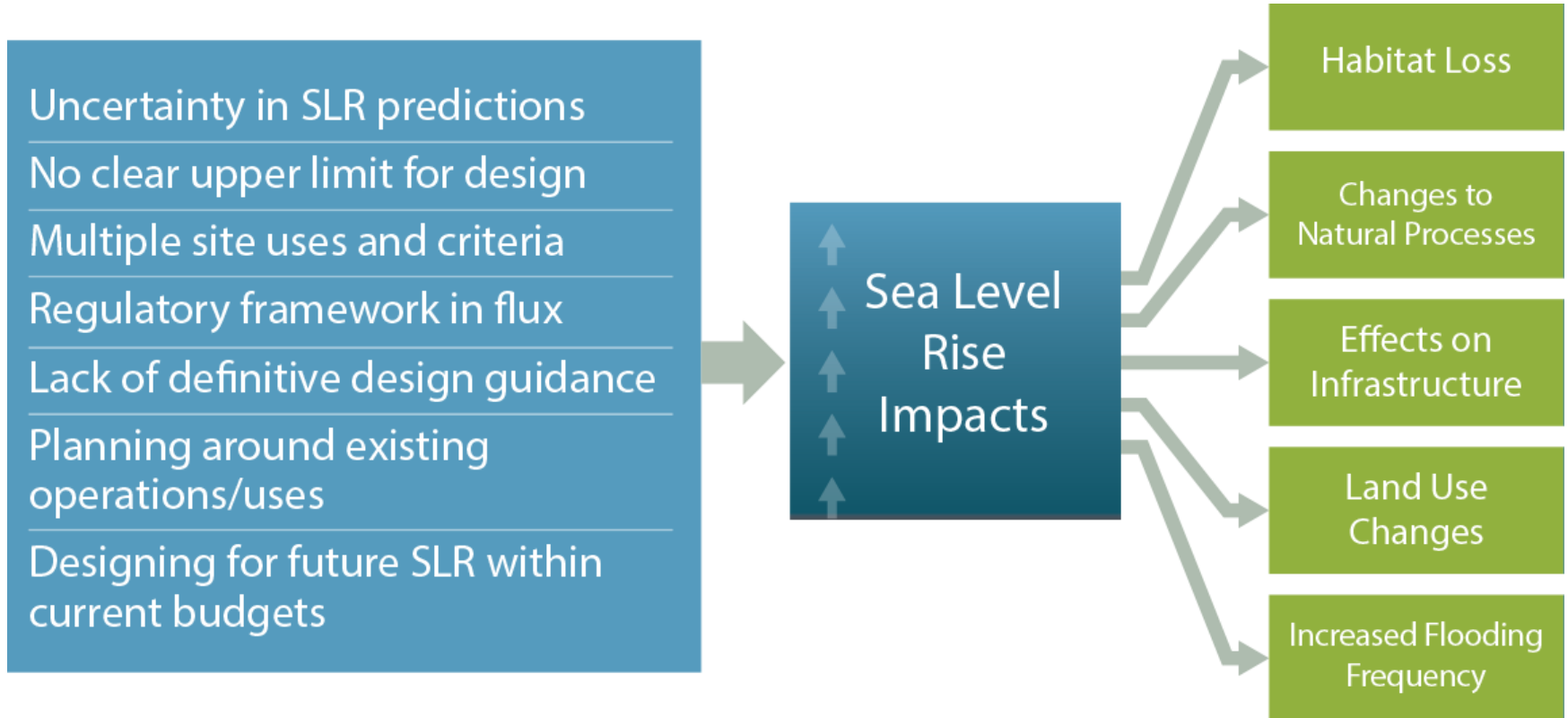
Study Objectives

- Site specific sea level rise (SLR) vulnerability assessment
- Facilitate the Town to eventually develop a Comprehensive SLR Adaptation Plan for the longer term (50 to 100 years)
 - Key aspects - nuisance flooding and storm induced flooding

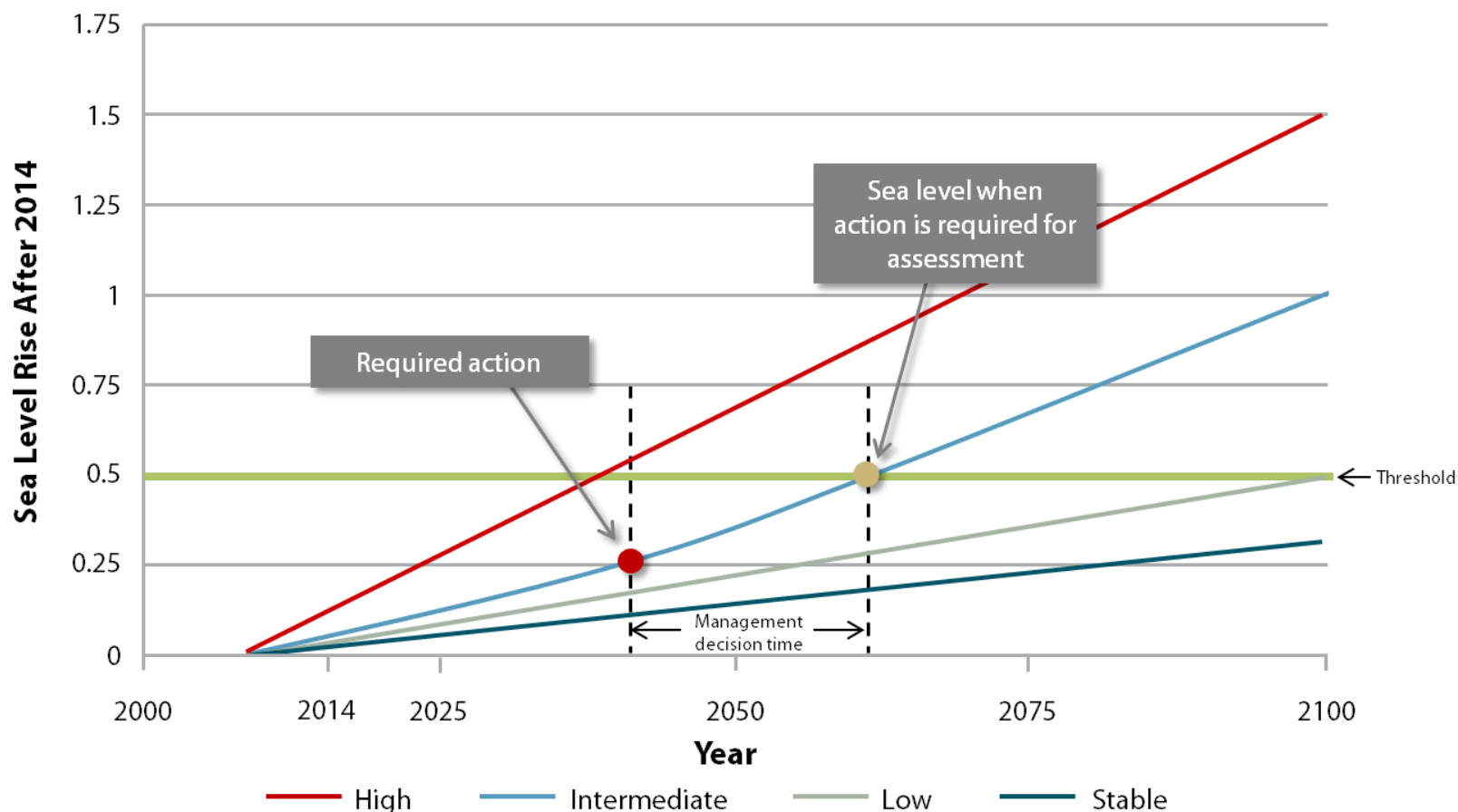
Key Study Steps

- Database set up/refinement
- Selection of SLR scenario
- Identifying criteria of interest
- SLR risk inundation mapping

Challenges of Quantifying SLR Risks



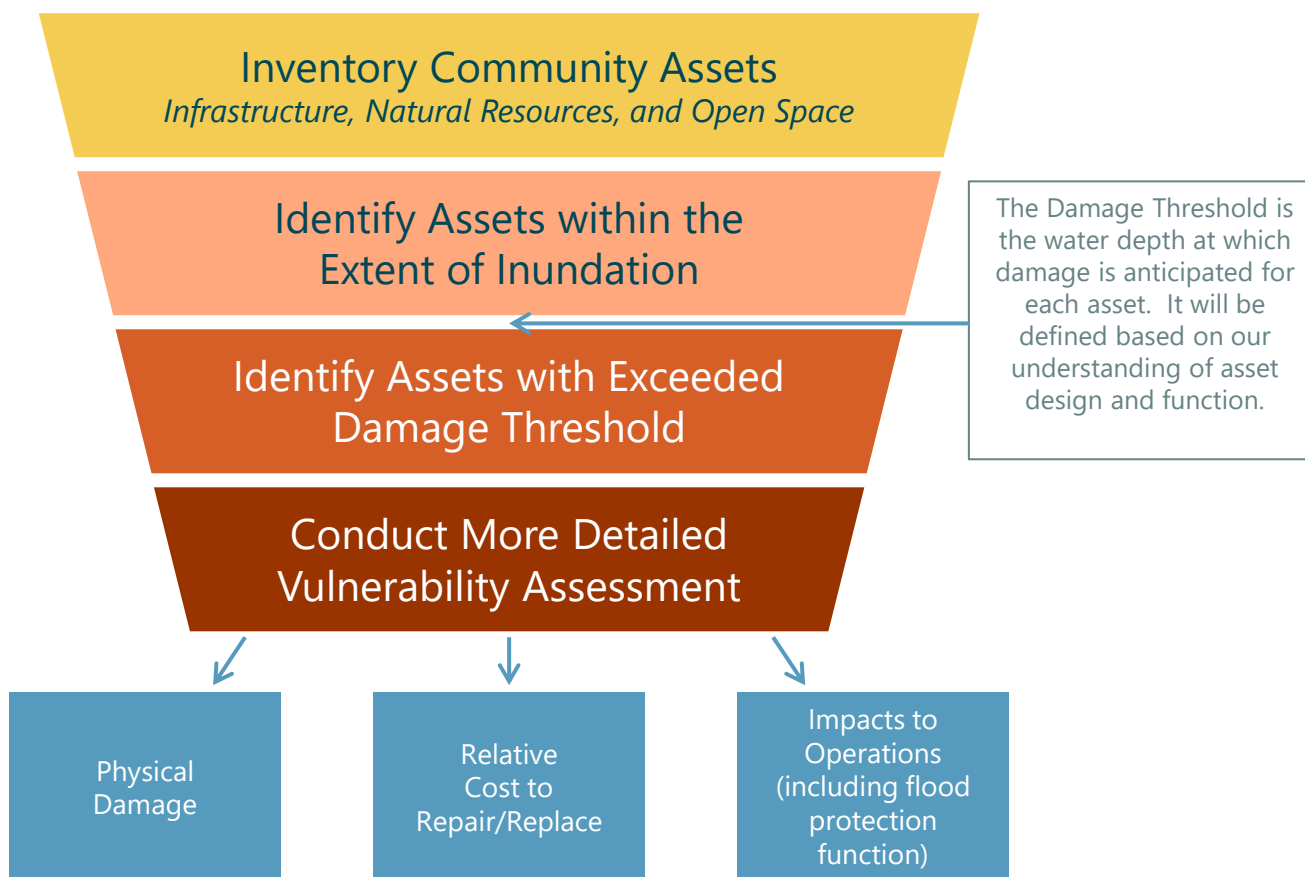
Example Metrics/Triggers for Action



Source:

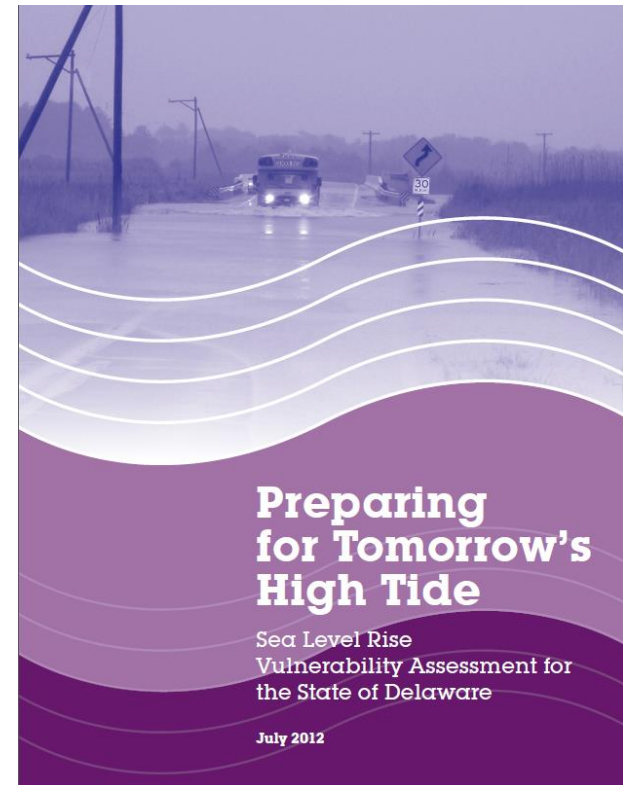
DNREC Delaware Coastal Programs, 2012. *Preparing for Tomorrow's High Tide: Sea Level Rise Vulnerability Assessment for the State of Delaware*. Dover, DE. Department of Natural Resources and Environmental Control.

Example Vulnerability Assessment



Background/Reports Reviewed

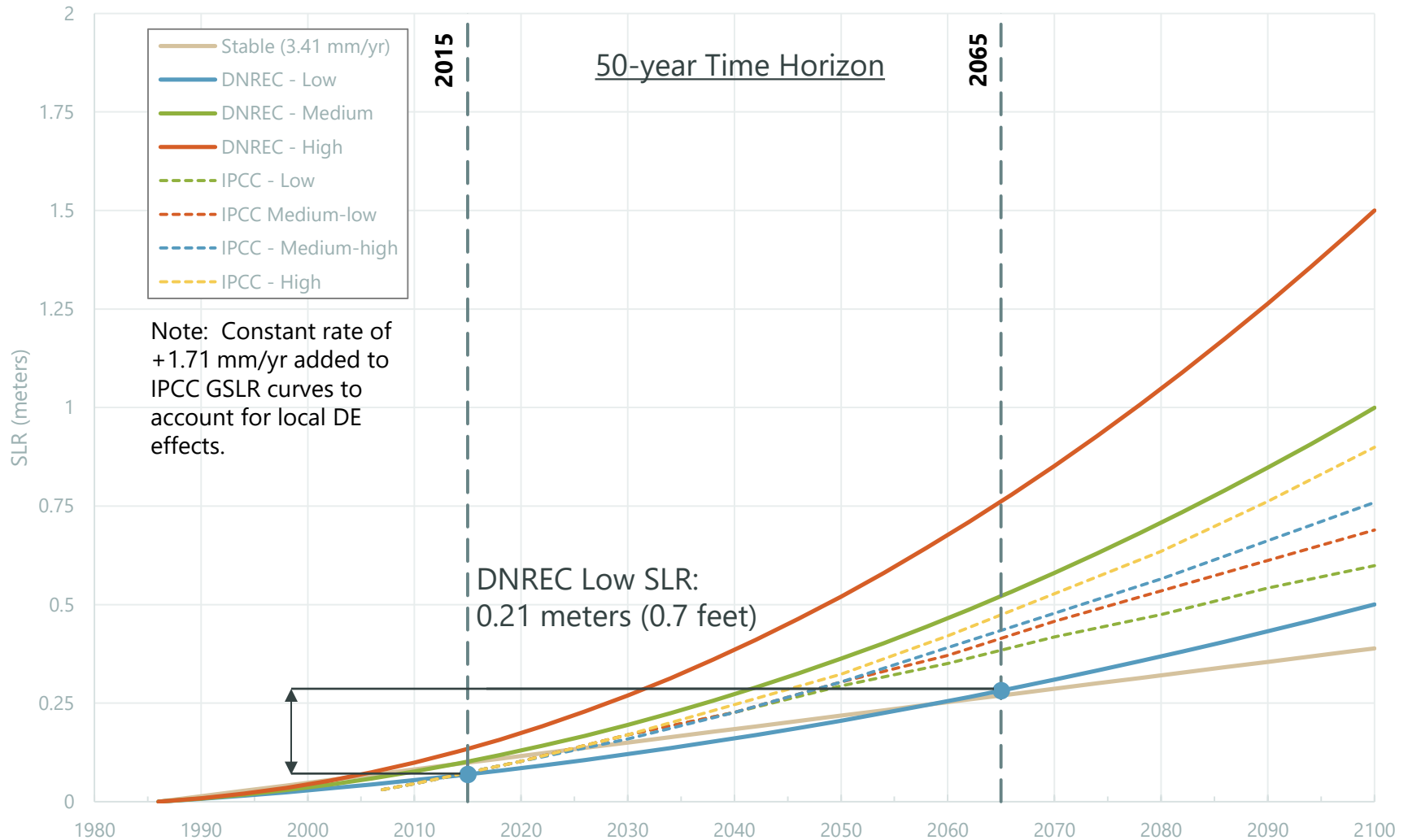
- *Recommended Sea Level Rise Scenarios for Delaware (2009)*
 - DNREC SLR Technical Workgroup
- *Preparing for Tomorrow's High Tide (2012)*
 - DNREC Delaware Coastal Programs
- *Fifth Assessment Report (AR5) (2013)*
 - Intergovernmental Panel on Climate Change



Summary of *Recommended SLR Scenarios*

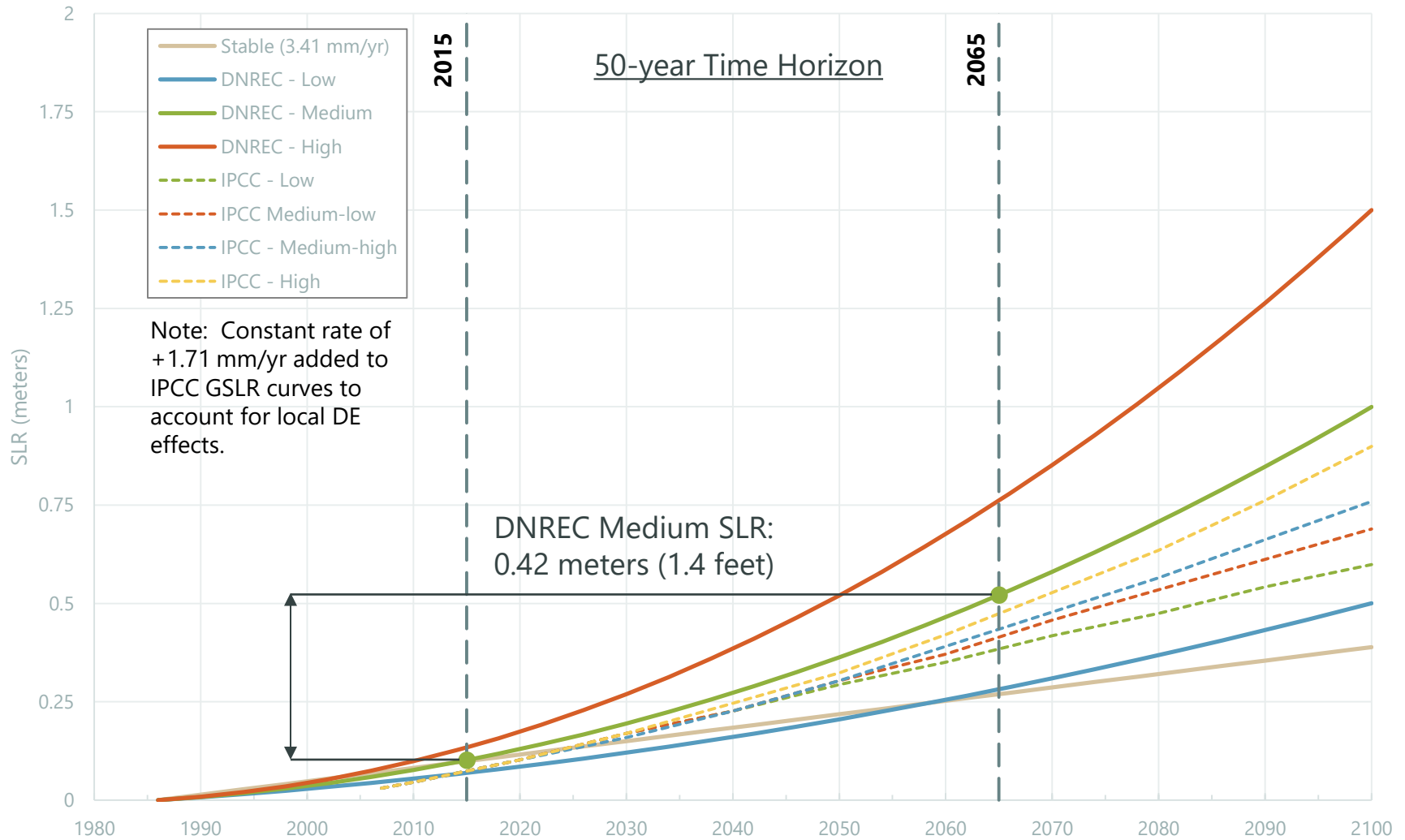
- Informs *Preparing for Tomorrow's High Tide*
- Workgroup reviewed publications and guidelines from various sources
 - USACE, NASA, NOAA, US Climate Change Science Program (CCSP), IPCC Fourth Assessment Report (AR4)
- Developed conversion from GSLR to LSLR
 - Accounts for local geologic effects (e.g., subsidence)
 - Assuming difference from GSLR and historic Lewes LSLR is constant (+1.65 mm/yr)
 - Updated LSLR for Lewes increases difference to +1.71 mm/yr
- Recommended NRC model used by USACE
 - 0.5 (Low), 1.0 (Med.), and 1.5 (High) meters by 2100
 - Model can be adjusted for intermediate time horizons

NRC vs. IPCC AR5



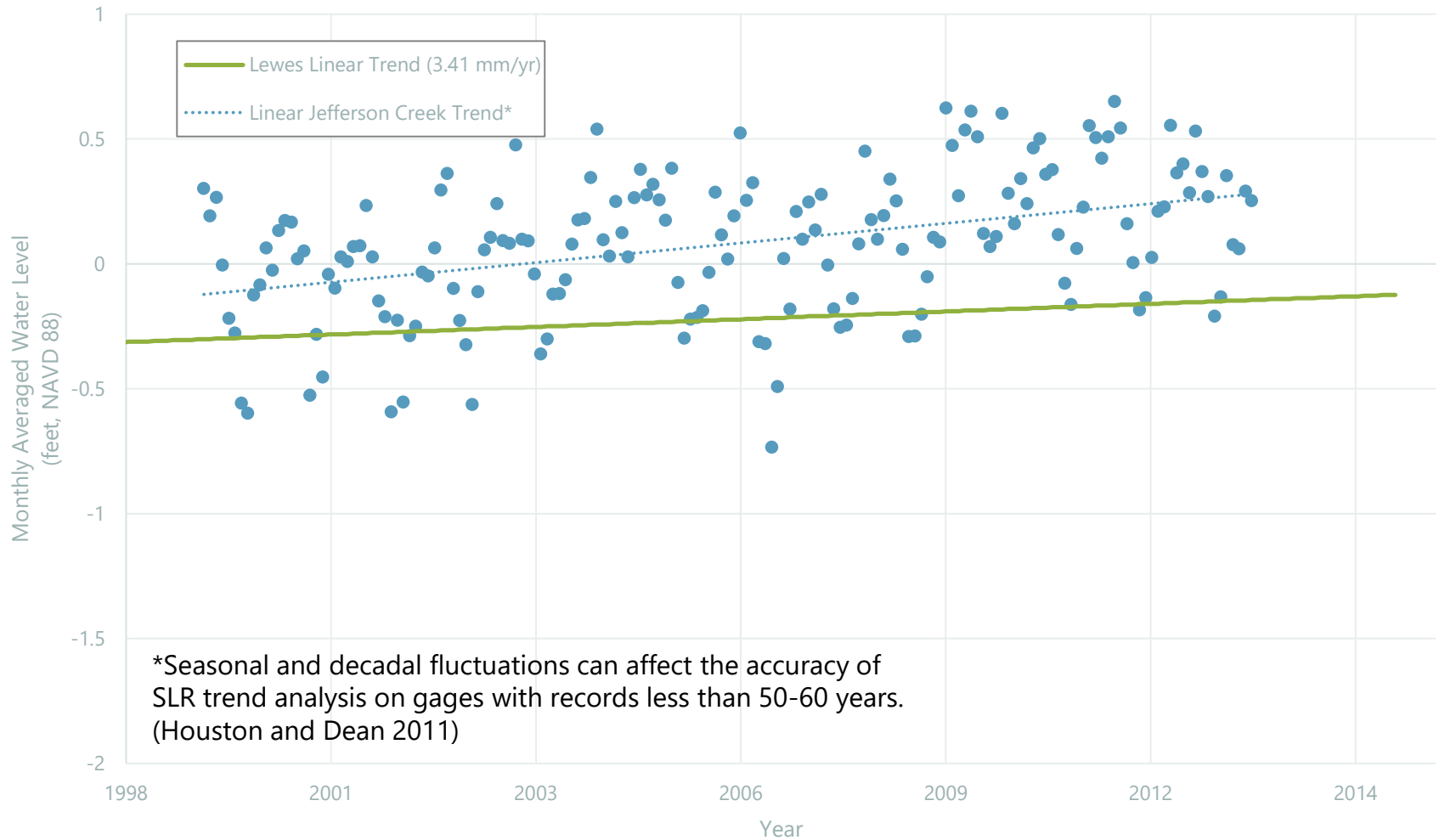
DNREC vs. IPCC Sea Level Rise Predictions

NRC vs. IPCC AR5



DNREC vs. IPCC Sea Level Rise Predictions

Jefferson Creek Mean Sea Level Trend



Jefferson Creek (South Bethany) Tide Data

Tide Data Analysis

- Tidal records less than 50-60 years can be affected by decadal fluctuations
- Length of record
 - Lewes: 96 years
 - Jefferson Creek: 16 years
- We recommend the continuation of data collection at the Jefferson Creek gage

Summary of SLR Scenario Selection

- 50 year time horizon was chosen for South Bethany
 - This is the practical design life for typical municipal civil works projects
- The IPCC AR5 SLR trend lines are bound by the “Medium” and “Low” DNREC SLR recommendations
- Recommended SLR for 50 year time horizon (2065)
 - Lower bound: 0.7 feet (*DNREC – Low*)
 - Upper bound: 1.7 feet (*DNREC – Medium*)*

**Includes local DE correction factor of 0.3 feet (+1.71 mm/yr).*

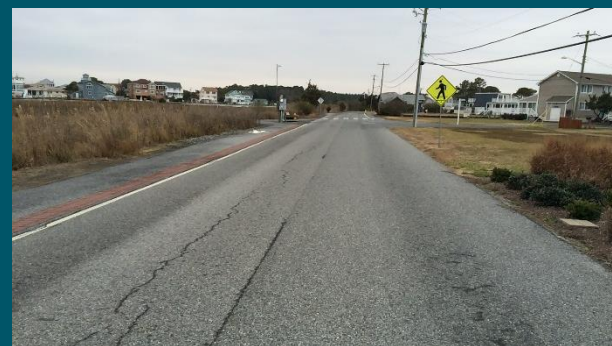


South Bethany SLR Study: Critical Infrastructure Prioritization



Types of Town Infrastructure

- Transportation
 - Streets
- Drinking Water System
- Sanitary Sewer System
- Electrical/Power
 - Ground-mounted Transformers
- Bulkheads
- Stormwater System
 - Catch Basins and Outfalls
- Open Space
 - Wetlands and other green space
- Dunes and Beaches
- Town Buildings



Evaluation Criteria

- Public Safety
- Continuity of Town Operations
- Property Value
- Quality of Life
- Cost Effectiveness

Prioritization Table

Infrastructure Type	Public Safety	Town Operations	Property Value	Quality of Life	Cost Effectiveness	Total Score
Transportation (Streets)	4	4	4	4	4	20
Electrical/Power (Ground-mounted Transformers)	4	3	3	3	3	16
Drinking Water System	3	2	3	4	3	15
Sanitary Sewer System	3	2	3	3	3	14
Bulkheads	2	2	3	3	3	13
Town Buildings	3	3	2	2	3	13
Stormwater System (Catch Basins and Outfalls)	2	2	2	3	3	12
Dunes/Beaches	2	2	3	3	2	12
Open Space/Wetlands	1	1	2	2	1	7

Note: Scores reflect relative importance [(1-4); with 4 being most important] of infrastructure with regard to the evaluation criteria

Table Developed By Averaging Inputs From Five Committee Members at The November 16, 2015 SLR&SS Committee Meeting

Summary

- Infrastructure Recommended for Inundation Analysis
 - Transportation (Streets)
 - Electrical/Power (Ground-mounted transformers)
 - Bulkheads
 - Stormwater System (Catch Basins and Outfalls)
 - Direct impact to road flooding
- High-Rated Infrastructure not Recommended for Inundation Analysis
 - Drinking Water and Sanitary Sewer Systems
 - Closed systems below grade



South Bethany SLR Study: Infrastructure Vulnerability Analysis and Recommendations

Bulkhead Inundation at 2065 MHHW (0.7 feet of SLR)



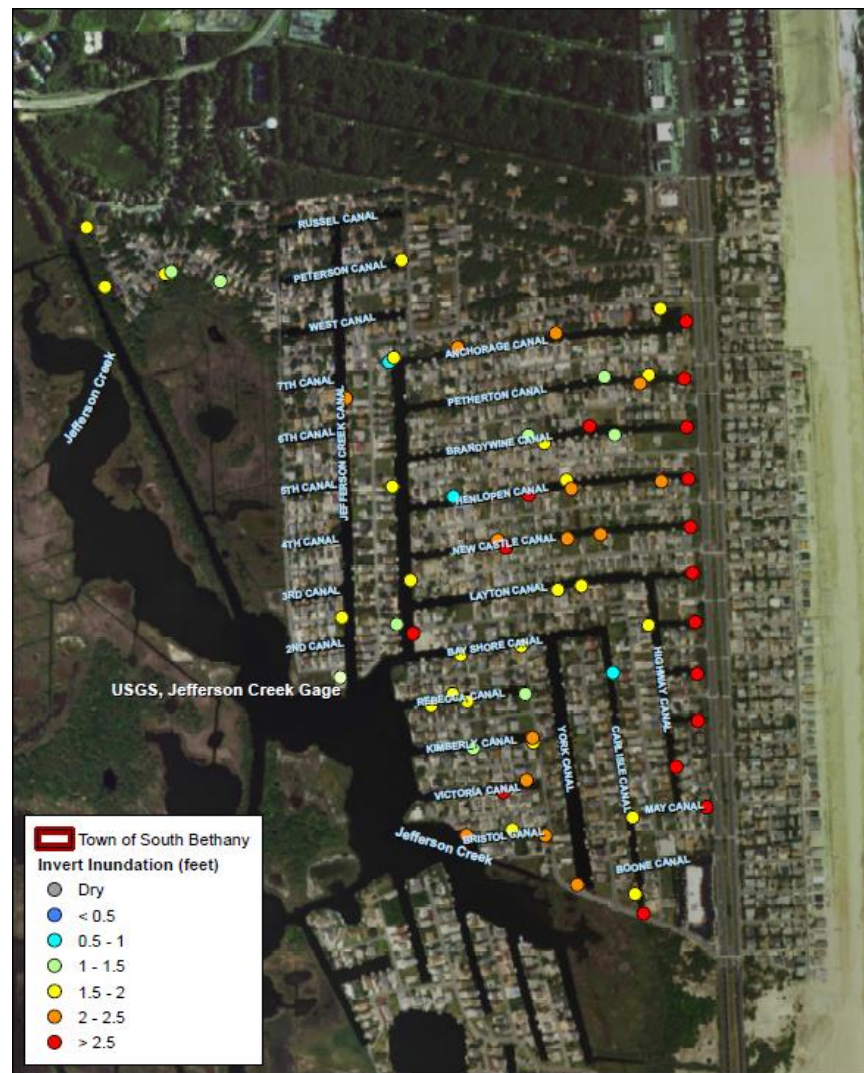
Bulkhead Inundation at 2065 MHHW (1.7 feet of SLR)



Outfall Invert Inundation at 2065 MHHW (0.7 feet of SLR)



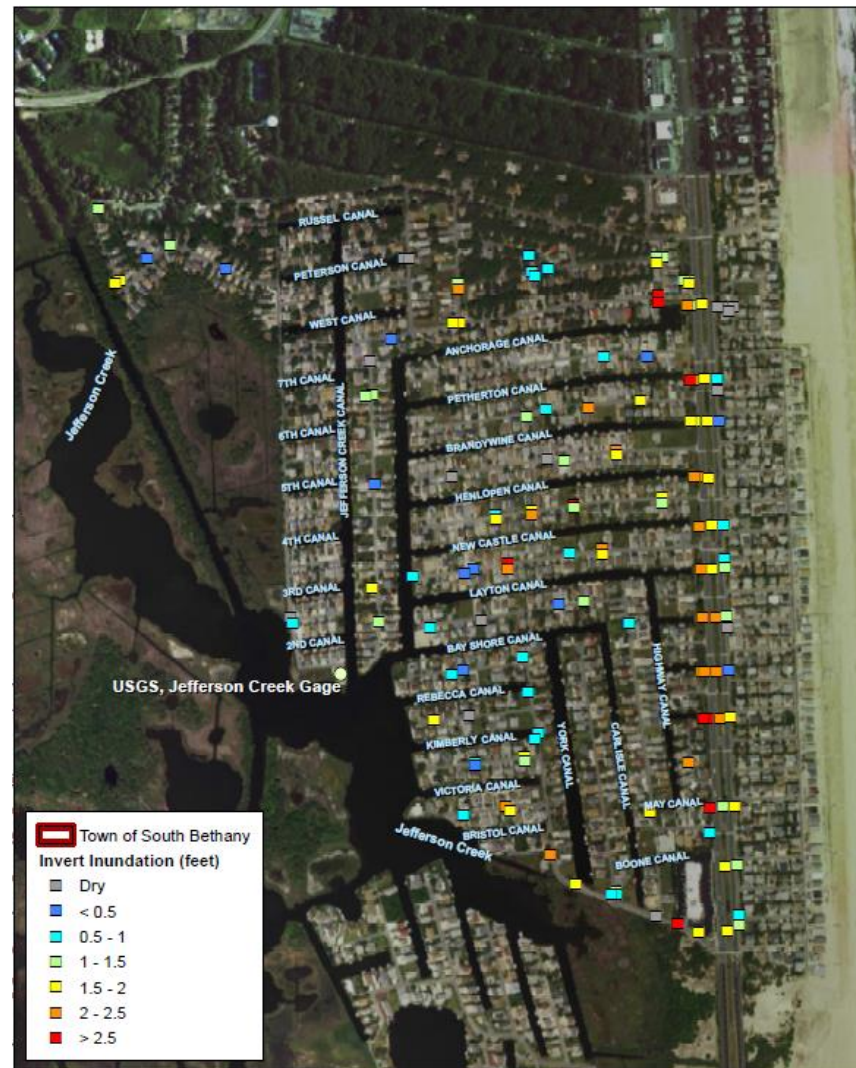
Outfall Invert Inundation at 2065 MHHW (1.7 feet of SLR)



Catch Basin Invert Inundation at 2065 MHHW (0.7 feet of SLR)



Catch Basin Invert Inundation at 2065 MHHW (1.7 feet of SLR)



Catch Basin Grate Inundation at 2065 MHHW (0.7 feet of SLR)



Catch Basin Grate Inundation at 2065 MHHW (1.7 feet of SLR)



Street Centerline Inundation at 2065 MHHW (0.7 feet of SLR)



Street Centerline Inundation at 2065 MHHW (1.7 feet of SLR)



Ground Transformer Inundation at 2065 MHHW (0.7 feet of SLR)



Ground Transformer Inundation at 2065 MHHW (1.7 feet of SLR)





South Bethany SLR Study: Recommended Future Phases

Recommended “Actions” for Town

- Allow bulkheads to be raised by property owners in areas showing high vulnerability to SLR
- Install backflow preventers on Town stormwater outfalls
- Raise street levels in areas showing high vulnerability to SLR
- Raise ground-mounted transformers that are deemed vulnerable
- Develop Town-specific SLR adaptation plan

Future Tasks

- *Development of SLR & SS Mapping*
 - Incorporate the effects of storm surge into the inundation and SLR study, using desktop analysis
 - Identify uncertainties
- *Develop Mitigation Plan & Funding Options*
 - Identify the most feasible mitigation steps/efforts available for each of the critical risks
 - Determine the order of magnitude costs for each of the recommended mitigation efforts for each risk.
 - Determine funding options that may be available to the South Bethany Council for inclusion in the final plan (for example, the Town, Sussex County, State of Delaware, or the Federal Government).

Future Tasks (Cont'd)

- *Coastal Resiliency (SLR & SS) Adaptation Plan*
 - Summarize the findings of the Study into a comprehensive SLR Adaptation Plan for South Bethany.
 - Determine the trigger points in time for each risk and define when it would be necessary to fund, and also to begin the recommended mitigation effort(s) based on the recommended SLR projections.
 - Determine/recommend steps, procedures and costs necessary to measure, check and refine (if needed) the SLR rate projections, based on real-time trends over time, and the associated trigger points
 - Enable the Town to revise the Plan in the future

Questions/Discussion

